

ABSTRACT

The difference between the neutron radius R_n of a heavy nucleus and the proton radius R_p is believed to be on the order of several percent. This qualitative feature of nuclei, which is essentially a neutron skin, has proven to be elusive to pin down experimentally in a rigorous fashion. We propose to measure the parity-violating electroweak asymmetry in the elastic scattering of polarized electrons from ^{208}Pb at an energy of 850 MeV and a scattering angle of 6° . Since the Z_0 boson couples mainly to neutrons, this asymmetry provides a measure of the size of R_n with respect to R_p that can be interpreted with as much confidence as traditional electron scattering data. The projected experimental precision corresponds to a $\pm 1\%$ determination of R_n , which will access the range of values predicted by nuclear theory, thus establishing the existence of the neutron skin if it is of the expected size.